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Navy Department
Washington 25, D. C.

Second Bi-Monthly Progress Report

A STUDY OF FUNDAMENTAL MECHANICAL PROPERTIES OF CERAMIC SINGLE CRYSTALS

Contract N600 (19)-59749

March 15 through May 14, 1963

By: P. T. B. Shaffer
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May 22, 1963

This program is supported by
Bureau of Naval Weapons
Department of the Navy
Washington 25, D. C.

SUMMARY

Additional data on strength and elastic properties of boron-doped silicon carbide crystals have been obtained on thin (10-70 μ) crystals. Analyses are being made to determine the specific effect of impurities on strength.

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I. INTRODUCTION

This is the second bi-monthly progress report to be released on research sponsored by the Bureau of Naval Weapons under Contract N-600 (19)-59749. It covers the period March 15 through May 14, 1963. This research is a continuation of that previously conducted under Bureau of Naval Weapons Contract NOw-61-0676-c.

II. WORK PROGRESS

A. Apparatus

The apparatus for measuring elastic modulus and breaking strength of thinner crystals (10-70μ thick) has been put in operation. The minimum and maximum detectable load and deflection are 0.225 and 40 grams, and 0.000354 and 0.100 inches, respectively.

B. Strength

Twenty-six additional samples of boron-doped silicon carbide, ultrasonically cut from large crystals, were broken. No exceptional strength values were obtained (see Table No. I).

C. Young's Modulus

Seventeen sample bars cut from boron-doped silicon carbide crystals were measured. Elastic modulus values from 38 to 102 million psi were obtained (see Table No. I).

III. DISCUSSION AND FUTURE PLANS

The work during this report period has been directed to a large extent toward the refinement of apparatus and a study of existing data. Chemical analyses obtained on the boron-doped crystals reported earlier are as yet incomplete. When these data are available a statistical study of the boron-thickness-strength and boron-thickness-elasticity relationships will be made.

The effects of various polishing techniques will be investigated in order to find a means of improving specimen geometry with a minimum sacrifice in mechanical properties.

TABLE NO. I

Strength and Young's Modulus of Boron-Doped Silicon Carbide Crystals*

Crystal No.	Thickness (μ)	Young's Modulus (10^6 psi)	MOR (10^3 psi)
A-363-84	56.5	72.5	- **
-85	68.7	46.2	-
-86	59.7	93.7	110.0
-87	41.2	61.0	108.0
-88	93.5	43.7	-
-89	58.0	55.0	-
-90	49.3	52.8	62.2
-91	50.8	93.7	178.0
-92	56.4	92.3	65.7
-93	48.5	62.0	-
-94	56.5	53.1	70.8
-95	45.2	67.0	96.2
-96	28.5	102.0	22.2
-100	73.7	84.3	-

**Available load failed to fracture several samples.
*Ultrasonically cut from larger crystals.

A-485-2	102.0	-	47.0
-3	127.0	-	36.4
-4	38.2	-	12.1
-5	127.0	-	70.5
-6	112.0	-	10.5
-7	76.2	-	194.0
-8	71.0	-	3.3
-9	140.0	-	30.2
-10	96.5	-	31.8
-11	76.2	-	35.2
-12	43.2	-	57.7
-13	61.0	-	102.0
-14	58.5	-	32.4
-15	61.0	-	30.8
-16	25.4	56.2	115.0
-17	43.2	-	64.7
-18	28.8	44.1	96.0
-19	30.5	38.0	74.3

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